

## **Recent Delhi-NCR tremors do not signal of a big event, though a strong earthquake cannot be ruled out: WIHG**

**In the wake of the recent series of tremors in Delhi-NCR**, Wadia Institute of Himalayan Geology, an autonomous institute of the Department of Science and Technology, has said that such tremors are not unusual in the Delhi-NCR region, but indicate that strain energy is built up in the region.

They have said that since the seismic network is quite good, present micro to minor earthquakes in and around Delhi-NCR could be recorded.

Though our understanding, in terms of when, where and with how much energy (or magnitude) an earthquake can occur, is not clear, but the vulnerability of a region can be understood from the past seismicity, calculation of strain budget, mapping of active faults etc. The Delhi-NCR has been identified as the second highest seismic hazard zone (Zone IV). Sometimes, a vulnerable zone remains quiet, experiences small magnitude earthquakes that do not indicate any bigger earthquake, or receives a sudden jolt by a big earthquake without any call. Out of 14 small magnitude earthquakes in the Delhi-NCR, the 29th May Rohtak earthquake had the magnitude of 4.6.

The recent events cannot be defined as the ‘foreshocks’. If a big earthquake takes place in a region, all smaller events that occurred in the immediate past at that region are categorized as the foreshocks. Therefore, scientifically all these tremors in the Delhi-NCR can be demarcated as the foreshocks only after a big earthquake takes place immediately. Though it cannot be predicted, a stronger earthquake posing a threat to people and properties cannot be ruled out. Since an earthquake cannot be predicted by any mechanism, the tremors cannot be described as the signal of a big event.

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### **Past earthquakes scenario In Delhi-NCR:**

The historical earthquake catalog shows that there were strong earthquakes of ~ 6.5 magnitude at Delhi in 1720; 6.8 at Mathura in 1803; 5.5 near Mathura in 1842; 6.7 near Bulandshahar in 1956; 6.0 near Faridabad in 1960; 5.8 near Moradabad in 1966 in the Delhi-NCR.

### **Why earthquakes happen in Delhi-NCR?**

All the earthquakes in Delhi-NCR are due to the release of strain energy, which have been accumulated as a result of northward movement of Indian plate and its collision with the

Eurasian plate, through the fault or weak zones. There are so many weak zones and faults in the Delhi-NCR: Delhi-Haridwar ridge, Mahendragarh-Dehradun subsurface fault, Moradabad fault, Sohna fault, Great boundary fault, Delhi-Sargodha ridge, Yamuna river lineament, Ganga river lineament etc. We must understand that the Himalayan seismic belt, where the Indian plate collided with the Eurasian plate and underthrust beneath the Himalayan wedge, accumulates strain energy at the plate boundary due to relative movement of plates against each other causing crustal shortening and deformation of rocks. These energy can be released through the weak zones and faults in the form of earthquakes ranging from micro (<3.0), minor (3.0-3.9), light (4.0-4.9), moderate (5.0-5.9), strong (6.0-6.9), major (7.0-7.9) or great (>8.0) earthquake, defined as per the amount of energy released. The small magnitude earthquakes are frequent, but large magnitude earthquakes are rare to very rare. It is the large earthquakes that cause severe damages both to structures and properties.

### **Impact of Earthquakes in the Himalaya to Delhi-NCR:**

The Isoseismals of the 1905 Kangra (7.8), 1934 Bihar-Nepal (8.0), 1950 Assam (8.6), 2005 Muzaffarabad (6.7) and 2015 Nepal (7.8) earthquakes in the Himalayan arc are bounded by the Main Central Thrust (MCT) to the north and the Himalayan Frontal Thrust (HFT) to the south. These earthquakes are the result of slip on a décollement surface i.e. the contact between the under thrusting Indian plate and overlying Himalayan wedge, which extends southward from 16-27 km depth beneath the MCT to its surficial expression as the HFT at a distance of 50-100 km from MCT.

The rupture areas due to large earthquakes show gaps along the Himalayan arc, which have not experienced great earthquakes for a long time, and are identified as the future potential zones for great earthquakes. Three main seismic gaps have been identified in the Himalaya: the Assam Gap between the 1950 Assam earthquake and the 1934 Bihar-Nepal earthquake; the Kashmir Gap between the 1905 Kangra earthquake and the 1975 Kinnaur earthquake; and the ~700 km long Central Gap between the 1905 Kangra earthquake and the 1934 Bihar-Nepal earthquake. The entire NW-NE Himalayan belt lies in the highest seismic potential zone V and IV, where major to great earthquakes can take place.

### ***Neighbouring faults and ridges***

There are so many faults, ridges, and lineaments transverse to the Himalayan arc, large sediment thickness in the Ganga Alluvium Plains to the north of Delhi-NCR. Again, the Delhi-NCR is ~200 km away from the Himalayan arc. Therefore, a major earthquake in the Himalayan seismic belt may also be a threat to Delhi-NCR. The Garhwal Himalaya, lying in the Central Seismic Gap and north of Delhi-NCR, has experienced the 1991 Uttarkashi earthquake (6.8), 1999 Chamoli earthquake (6.6) and 2017 Rudraprayag earthquake (5.7), and is due for a major to great earthquake. Such a scenario can make a pronounced impact to the north India and Delhi-NCR.

### **Precautions:**

The subsurface structures, geometry, and disposition of faults and ridges are to be investigated thoroughly using Geo-scientific studies in and around Delhi and NCR. Since the soft soils do not

support the structures' foundations, structures anchored to bedrock or stiff soils in earthquake-prone areas suffer less damage. Thus, soil liquefaction studies are to be carried out to know the thickness of soft soils. Active faults are to be delineated, and lifeline structures or other infrastructures are to be avoided from nearby active faults, and to be constructed as per the guiding principles of the Bureau of Indian Standard (BIS). The outcome of recent micro zonation studies for Delhi-NCR by IMD should be considered for important construction.

### **Message to Common People:**

Earthquakes are not predictable but there lies a probability of a large to great earthquake with magnitude 6 and more in the highest seismic potential zone V and IV, which fall in the entire Himalaya and Delhi-NCR. The only solution to minimise the loss of lives and properties is the effective preparedness against the earthquake. Countries like Japan have proved this; where earthquakes are common phenomenon, yet the losses are negligible. Annual mock-drill is a regular feature there. People's participation, cooperation and awareness are the key to success of this. Some of the precautions and preparedness are enumerated as:

#### **(A) Before an earthquake.**

##### **(i) Earthquake mock drill/Construction of buildings/Houses**

- Perform earthquake mock-drill annually
- Incorporate earthquake-resilient construction to new buildings and retrofitting existing structures

##### **(ii) Preparation as an individual (in a family or society)**

- Sit together and chalk out mobile numbers for neighbours, society/colony, nears & dears, emergencies etc.
- Prepare a backup supply kit that include food (biscuit packets etc.), water, medications and first aid supplies, flash light, essential clothing and personal toiletries.
- Update the first-aid kit regularly.
- Choose at least two family meeting places: easy to identify, open and accessible places that are approachable.
- Identify a common place in society/colony/street to assemble for shelter, kitchen and first-aid

#### **(B) During an earthquake**

- Remain calm, as the ground shaking lasts for less than a minute.
- *Indoor:* Stay inside-“DUCK, COVER and HOLD”. Place yourself under sturdy furniture, cover as much of your head and upper body as you can. Hold onto the furniture. If you cannot get under sturdy furniture, move to an inside wall or archway and sit with your back to the wall, bring you knees to your chest and cover your head.
- Keep yourself away from mirrors and windows.
- Do not come out from the building during the shaking.
- *Outdoor:* Rush to an open area away from all structures, especially buildings, bridges and overhead power lines.

- *Driving:* Stop immediately at the road-side preferably in an open area away from any structure especially the bridge, overpass, tunnel and overhead power line. Stay as low as possible inside the vehicle.
- *If trapped in debris:*
- Do not light match box/lighter
- Do not shake body unnecessary and do not remove dust, it can create problem for breathing.
- Cover your face, if possible, with handkerchief/cloth.
- Hit something on pipe/wall etc. so that rescue team can find you.
- Do not shout unnecessary because it will tired you and dust/gases can go inside the body with breathing by this action.

**(C) After the Earthquakes:**

- Remain calm
- Move cautiously and check for unstable objects and other hazards above and around you.
- Check your body for injuries.
- Help those around you and provide first aid.
- Inspect gas, water and electric lines. If there are leaks or if there is any doubt about leaks shut of mains: evacuate immediately if you hear or smell gas and cannot shut it off. Reports leaks to the authorities.
- Stay out from damaged buildings.
- Listen to the radio/TV for emergency information and additional safety instructions.

**(D) Ready Stocks:**

- Keep enough stocks at home to meet the needs for at least seven days.
- Assemble a Disaster Supplies Kit with items during evacuations. Store these stocks in sturdy, easy to carry containers such as backpacks, duffle bags or covered trash containers.

**Other utilities and Note Points:**

- A seven day supply of water and food that would not spoil.
- One change of clothing and footwear per person, and one blanket or sleeping bag per person.
- A first aid kit that includes your family's prescription medications.
- Emergency tools including a battery-powered radio, flash light and plenty of extra batteries.
- Special items for infant, elderly or disable family members and sanitation supplies
- Do not keep any heavy material above the door height
- Do not sleep with your head below bulb/light/lamp.